CLAIMS

1. A olefin polymerization catalyst characterized by the formula

$$B(FluA)MQ_n \quad (3)$$

wherein:

a. Flu is a fluorenyl group substituted at at least one of the 4,5 positions by a bulky hydrocarbyl group containing at least four carbon atoms;

b. A is a substituted or an unsubstituted cyclopentadienyl group, a substituted or unsubstituted indenyl group, or a heteroorgano group XR in which X is a heteroatom from Group 15 or 16 of the Periodic Table, and R is an alkyl group, a cycloalkyl group or an aryl group containing from 1 to 20 carbon atoms;

c. B is a structural bridge between A and Flu imparting stereorigidity to the ligand structure (FluA);

d. M is a Group 4 or Group 5 transition metal;

e. Q is selected from the group consisting of Cl, Br, I, an alkyl group, an amino group, an aromatic group and mixtures thereof; and

f. n is 1 or 2.

2. The catalyst composition of claim 1 wherein Flu is substituted at both of the 4 and 5 positions with a bulky hydrocarbyl group containing at least four carbon atoms.

3. The catalyst composition of claim 1 wherein Flu is mono-substituted at the 4(5) position and is otherwise unsubstituted.

4. The catalyst composition of claim 1 wherein Flu is mono-substituted at the 4(5) position and is di-substituted at the 2,7 positions with alkyl groups, phenyl or substituted phenyl groups, which may be the same or different.

5. The catalyst composition of claim 4 wherein the fluorenyl group Flu is di-substituted at the 2,7 positions with substituents of a lower molecular weight than the substituent at the 4(5) position.

6. The catalyst composition of claim 4 wherein the fluorenyl group Flu is di-substituted at the 3,6 position with alkyl groups of a lower molecular weight than the substituent at the 4(5) position.

7. The catalyst composition of claim 1 wherein A is a heteroorgano group XR and X is N, P, O or S.

8. The composition of claim 6 wherein 7 is N and R is a mononuclear aromatic group or an alkyl group or cycloalkyl group containing from 1 - 20 carbon atoms.

9. The composition of claim 1 wherein said structural bridge B is characterized by the formula ER'R" wherein E is C, Si or Ge and R' and R" are each independently an alky group, an aromatic group or a cycloalkyl group.

10. The composition of claim 1 wherein A is a substituted or unsubstituted cyclopentadienyl group.

11. The composition of claim 10 wherein M is titanium, zirconium or hafnium.

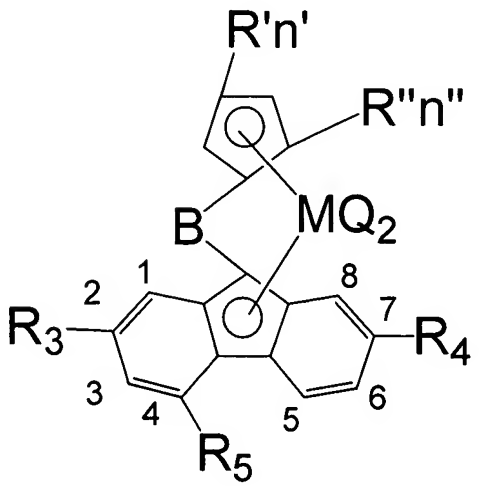
12. The composition of claim 11 wherein Flu is substituted at one of the 4 or 5 positions with a phenyl group which is substituted or unsubstituted.

13. The composition of claim 12 wherein A is cyclopentadienyl group substituted at the 3 position with a tertiary butyl group.

14. The composition of claim 13 wherein said cyclopentadienyl group is substituted at the 5 position with a methyl group.

15. The composition of claim 13 wherein said fluorenyl group is di-substituted at the 2,7 positions with isopropyl or tertiary butyl groups.

16. An olefin polymerization catalyst characterized by the formula



(4)

wherein:

a. R' is a $C_1 - C_4$ alkyl group or an aryl group;

b. R" is a methyl group or an ethyl group;

c. n' is 0 or 1;

d. n" is 0 or 1;

e. B is a structural bridge between the fluorenyl and cyclopentadienyl groups;

f. M is titanium, zirconium or hafnium;

g. Q is selected from the group consisting of Cl, Br, I, an alkyl group, an amino group, an aromatic group and mixtures thereof;

h. R_3 and R_4 are the same or different and are each a hydrogen or an isopropyl group or a tertiary butyl group, or phenyl, or substituted phenyl group; and

i. R_5 is an alkyl or aromatic group which has a higher molecular weight than R_3 or R_4.

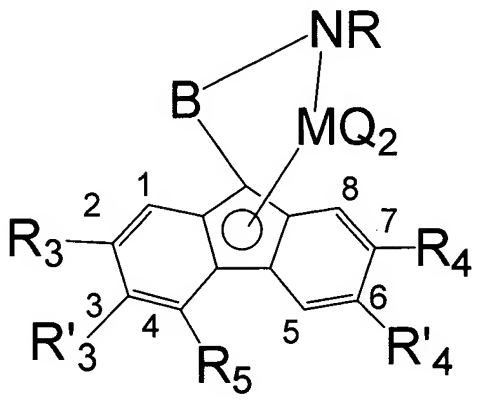
17. The catalyst of claim 16 wherein R' is a tertiary butyl group and n' is 1, R_3 and R_4 are each tertiary butyl groups and R_5 is a substituted or unsubstituted phenyl group.

18. The catalyst composition of claim 17 wherein n" is 1.

19. The catalyst of claim 18 wherein R" is a methyl group.

20. The composition of claim 17 wherein R_5 is a 4-tertiary butyl phenyl group.

21. An olefin polymerization catalyst characterized by the formula



(5)

wherein:

a. R is a mononuclear aromatic group, or an alkyl group or cycloalkyl group containing from 1 - 20 carbon atoms;

b. B is a structural bridge between the fluorenyl group and the heteroatom group NR;

c. M is titanium, zirconium or hafnium;

d. Q is selected from the group consisting of Cl, Br, I, an alkyl group, an amino group, an aromatic group and mixtures thereof;

e. R_3 and R_4 are the same or different and are each a hydrogen or a $C_1 - C_4$ alkyl group, or phenyl, or substituted phenyl group;

f. R'_3 and R'_4 are each hydrogen or a $C_1 - C_4$ alkyl group providing that when R_3 and R_4 are hydrogen, R'_3 and R'_4 are hydrogen; and

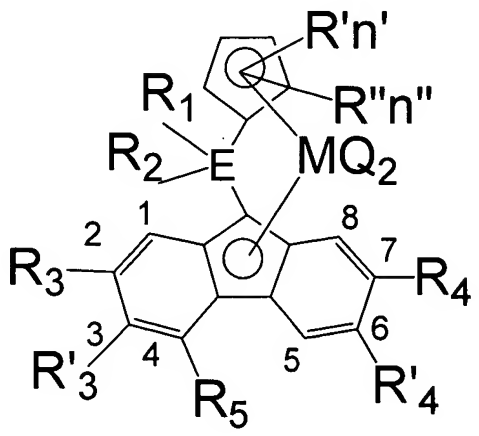
g. R_5 is an alkyl or aromatic group which has a higher molecular weight than R_3 or R_4.

22. The catalyst of claim 21 wherein R_3 and R_4 are each a tertiary butyl group, R'_3 and R'_4 are each a $C_1 - C_4$ alkyl group and R_5 is a substituted or unsubstituted phenyl group.

23. The composition of claim 22 wherein R is tertiary butyl group.

24. The catalyst of claim 21 wherein R_3 and R_4 are each hydrogen and R_5 is a tertiary butyl group, a phenyl group, or a substituted phenyl group.

25. An olefin polymerization catalyst characterized by the formula



(6)

wherein:

a. R' is a $C_1 - C_4$ alkyl group or an aryl group;

b. n' is from 0 to 3;

c. R" is an alkyl group of a lower molecular weight than R';

d. n" is 0 or 1;

e. E is –C– or –Si–;

f. R_1 and R_2 are the same or different and are each a methyl group, a phenyl group or a substituted phenyl group;

g. M is titanium, zirconium or hafnium;

h. Q is a chlorine, a methyl group or a phenyl group;

i. R_3 and R_4 are the same or different and are each a hydrogen or a $C_1 - C_4$ alkyl group, or phenyl, or substituted phenyl group;

j. R'_3 and R'_4 are each hydrogen or a $C_1 - C_4$ alkyl group provided that when R_3 and R_4 are hydrogen, R'_3 and R'_4 are hydrogen; and

k. R_5 is an alkyl group or aromatic group which has a higher molecular weight than R_3 or R_4.

26. The catalyst of claim 25 wherein n' and n" are 0, R_3 and R_4 are each hydrogen, and R_5 is a tertiary butyl group or a substituted or unsubstituted phenyl group.

27. The catalyst of claim 25 wherein R_3 and R_4 are each independently a $C_1 - C_4$ alkyl group and R_5 is a substituted or unsubstituted phenyl group.

28. The catalyst composition of claim 25 wherein R_3 and R_4 are tertiary butyl groups, R_5 is a substituted or unsubstituted phenyl group and n' and n" are each 0.

29. The catalyst composition of claim 25 wherein n' is 1 and R' is a tertiary butyl group substituted on said cyclopentadienyl group at the 3 position.

30. The catalyst composition of claim 29 wherein R_3 and R_4 are tertiary butyl groups and R_5 is a phenyl group or a 4-tertiary butyl phenyl group.

31. The catalyst composition of claim 29 wherein n" is 1 and R" is a methyl group substituted on said cyclopentadienyl group at the 5 position.

32. A process for the polymerization of an ethylenically unsaturated monomer comprising:

a. providing a transition metal catalyst characterized by the formula

$$B(FlA)MQ_n \quad (3)$$

wherein:

i. Flu is a fluorenyl group substituted at at least one of the 4,5 positions by a bulky hydrocarbyl group containing at least four carbon atoms;

ii. A is a substituted or an unsubstituted cyclopentadienyl group, a substituted or unsubstituted indenyl group, or a heteroorgano group XR in which X is a heteroatom from Group 15 or 16 of the Periodic Table, and R is an alkyl group, a cycloalkyl group or an aryl group containing from 1 to 20 carbon atoms;

iii. B is a structural bridge between A and Flu, imparting stereorigidity to the ligand structure (FlA);

iv. M is a Group 4 or Group 5 transition metal;

v. Q is selected from the group consisting of Cl, Br, I, an alkyl group, an aromatic group and mixtures thereof; and

vi. n is 1 or 2;

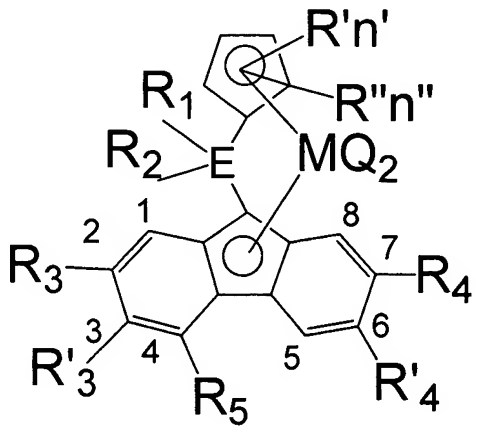
b. providing an activating cocatalyst component;

c. contacting said catalyst component and said cocatalyst component in a polymerization reaction zone with an ethylenically unsaturated monomer under polymerization conditions to produce a polymer product by polymerization of said monomer; and

d. recovering said polymer product from said reaction zone.

33. The process of claim 32 wherein said monomer comprises propylene and said polymer product is a polypropylene homopolymer or copolymer.

34. The process of claim 33 wherein said transition metal catalyst is characterized by the formula



(6)

wherein:

a. R' is a $C_1 - C_4$ alkyl group or an aryl group;

b. n' is from 0 to 3;

c. R" is an alkyl group of a lower molecular weight than R';

d. n" is 0 or 1;

e. E is –C– or –Si–;

f. R_1 and R_2 are the same or different and are each a methyl group, a phenyl group or a substituted phenyl group;

g. M is titanium, zirconium or hafnium;

h. Q is a chlorine, a methyl group or a phenyl group;

i. R_3 and R_4 are the same or different and are each a hydrogen or a $C_1 - C_4$ alkyl group or phenyl, or substituted phenyl group;

j. R'_3 and R'_4 are each hydrogen or a $C_1 - C_4$ alkyl group provided that when R_3 and R_4 are hydrogen, R'_3 and R'_4 are hydrogen;

k. R_5 is an alkyl group or aromatic group which has a higher molecular weight than R_3 or R_4;

and said polymer product is an isotactic polypropylene.

35. The process of claim 33 wherein n' is 1 and R' is a tertiary butyl group substituted on said cyclopentadienyl group at the 3 position.

36. The process of claim 34 wherein R_3 and R_4 are tertiary butyl groups and R_5 is a phenyl group or a 4-tertiary butyl phenyl group.

37. The process of claim 35 wherein n" is 1 and R" is a methyl group substituted on said cyclopentadienyl group at the 5 position.